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User Scenario Functional Analysis

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Working Paper

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1. Introduction

1.1 Purpose

The purpose of this white paper is to provide a functional analysis of the user model inputs from the scenarios that have been collected by the modelers through formal and informal inquiries with science users. This information is provided as a technical input to the EOSDIS Core System (ECS) designers, developers, architecture teams, etc., for their analyses. In addition to the scenario text, the analysis includes the discussions and meeting minutes from the scenario collection trips and follow-up discussions with users. The primary objective of this paper is to provide a summary of the functional requirements gleaned from the scenarios and the subsequent analysis effort. This paper also provides an assessment of the impacts that these inputs have on the ECS specifications and requirements.

1.2 Organization

This paper is organized as follows:

- **Introduction–**This section identifies the high-level purpose of the paper and provides a quick overview of the organization of the document.
- **User Model and Requirements Analysis Process–**This section provides an overview of the context in which scenarios are collected, and defines their intent, then presents a description of the Recommended Requirements Database (RRDB) and analysis process. The RRDB is a tool to gather user feedback, suggestions, recommendations, and comments from the ECS user community. The RRDB entries are reviewed by a team of ECS scientists, engineers, and NASA representatives. The ideas and suggestions received through the RRDB that are approved are then forwarded to the ECS developers for implementation.
- **Scenario Implications of Science User Requirements and Observations–**This section presents the results of an analysis of all of the scenarios with respect to user-requested ECS services. A table is provided (Table 3.1) that illustrates the types of services requested by users and the individual scenarios that require these services. This section also examines the recommended requirements resulting from the scenarios and categorizes them into appropriate functional groups. Each recommendation is analyzed for architectural implications with the current RRDB status indicated.
- **ECS Policy Implications from Scenario Functional Analysis–**Policy implications are identified and presented in a high-level overview format with a plan for working with ESDIS for resolution.

References to RRDB record numbers are made throughout this document. The notation for an RRDB record number is a three digit number preceded by a "#" sign. These should not be confused with the scenario numbers which are listed with the word "scenario" preceding the number. In addition, a scenario number followed by the word "old" refers to a scenario that was collected prior to the refocusing of the matrix in January of 1994. Appendix A2 contains both the current user matrix and the December 1993 user matrix for reference.

1.3 Review and Approval

This White Paper is an informal document approved at the Office Manager level. It does not require formal Government review or approval; however, it is submitted with the intent that review and comments will be forthcoming.

The ideas expressed in this White Paper are valid for the scenario comments collected through the month of April 1994.

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2. User Model and Requirements Analysis Process

This section provides an overview of the context in which scenarios are collected, defines their intent, then presents a description of the Recommended Requirements Database (RRDB), which is used to capture requirements/user needs indicated in the scenarios.

2.1 User Model Process

2.1.1 Scenario Overview

In the context of the User Model, a *user scenario* is a step-by-step description of the actions an ECS user takes in performing research or other work (from ECS User/Data Model: Approach and Plan White Paper). This description is "user-centric", and therefore takes the point of view of the user. Thus, ECS is treated as a black box providing all of the required functionality. A detailed analysis of the scenarios and assignment of requirements to various functional categories helps to determine the impact of a scenario on the evolving ECS Architecture.

User scenarios are classified according to the manner in which both the system and the data are accessed. The classification is embodied in the June 17, 1994 version of the User Scenario Matrix (see Appendix A2). The left column represents styles of access currently expected by the science users, while the top row identifies scale of endeavor. Entries in the matrix are short descriptions of the kind of scenario that represents that pattern of access. Modelers have worked closely with the science community to identify appropriate users from which to collect scenarios representative of each matrix cell.

2.1.2 Scenario Analysis

Once collected, scenarios were rigorously analyzed to define the user interaction with ECS and to identify the user needs. The scenario author performed several iterations with the user to develop an accurate scenario text. From this step-by-step text, templates were created tabulating descriptions of the type of user request, service invoked, data accessed and results of request. In addition, each step of the scenario was mapped into the data pyramid with both input and output attributes, and services implemented.

The scenario templates were then used by Activation Modelers to create a service "thread" for each step in the scenario. Essentially, the Activation Model process inverts the scenarios from a user perspective to a system perspective (i.e. scenarios ask the question "How does the system look to the user?" while the threads ask the question "How does the user look to the system?"). These system threads were then combined with demographic information and used as input to the Static Model. The purpose of the Static Model is to estimate the average volume per day of data accessed and/or distributed to the total user community (average is over a 365-day year) as well as an average number of times per day that each lower level service is invoked. Both the Activation and Static Models are the "front end" of the Performance Model (the results from the performance modeling activity are to be published in a separate document.).

During this Functional Analysis, scenarios were scrutinized from a functional requirements point-of-view to identify 1) unanticipated service, data, and information needs and 2) refine definition of known requirements. For details on scenarios, see the ECS User Scenario Notebook (194-00311TPW).

2.2 Requirements Analysis

The Recommended Requirements Database (RRDB) is a tool to gather feedback, suggestions, recommendations, and comments from the ECS user community. The RRDB entries are reviewed by a team of ECS scientists, engineers, and NASA representatives. The ideas and suggestions received through the RRDB that are approved are then forwarded to the ECS developers for implementation. The potential new requirements and user needs identified during functional analysis are entered into and tracked by the RRDB.

2.2.1 RRDB Process

Every recommendation entered into the RRDB is reviewed in a formal evaluation process for applicability to the ECS. During this process each recommendation is examined to see if it matches a current ECS requirement, or any similar RRDB recommendations. This preliminary analysis is the seed of the more detailed engineering analysis. An engineering analysis is performed on each entry and the information is sent to a panel called the Screening Team for review. If the Screening Team determines that implementation of the recommendation may cause significant cost and schedule impacts, or is a new requirement, it is sent, with their comments, to the next level of review, the Technical Assessment Panel. This group consists of the chief engineers and representatives of each segment. They evaluate the recommendation and determine whether or not its implementation is feasible. When the Technical Assessment Panel identifies a recommendation as a new requirement or new implementation, it is sent for review to the ECS Change Control Board (CCB). From this point on, the requirement continues to be tracked by the Technical Management Database (TMDB).

2.2.2 Engineering Analysis of Requirements

Entries in the RRDB are analyzed to determine if the recommendation represents a new requirement, example of existing requirement, "fleshing out" of existing requirement, etc. The RRDB Administration gathers information related to the recommendation from various documents and on-line sources, and from discussions with engineers and scientists, both internal and external to ECS. This information is then distilled into a brief engineering analysis that is attached to each record before it is sent for review by the Screening Team. This engineering analysis as well as the analysis from the Screening Team was used to provide for categorization into the four status groups and the RRDB comments *(Table 3.3)*.

3. Scenario-Based User Requirements and Observations

3.1 Introduction

This section provides overall insight into the type of services that users have identified will be useful to them in their research efforts. A table of the user-requested services is provided with demographic information to illustrate the number of science users that will have these service needs. This section also discusses, in detail, user-requested services that are truly new system recommendations or are variations of services that are currently planned for ECS.

3.2 User-requested ECS Services

A careful analysis of the user scenarios reveals the type of services that users of the ECS will require to support them in their research efforts. These services requirements must then be merged with demographic information to provide input to ECS developers. For example, one cannot say only that an "animation" service is required without providing information on the number of users expected to require that service. Because the functionality of the ECS will be phased in over time, it is important for developers to assess the impact of implementing each service. Knowing the number of users that will require each service will aid the developers in the prioritization of service implementation.

The results of the scenario analysis are presented in tabular form in Table 3.1. Each row in the table represents one scenario and the first column of the table identifies the scenario by its corresponding number in the June, 1994 user scenario matrix (see Appendix A). The second and third columns of the table contain the minimum expected number of science users and the maximum expected number of science users, respectively. All other column headings are user-requested services. If a scenario requested a particular service, an "X" was placed in the column of that service and the row for that scenario. In addition, the services are loosely grouped according to type at a high level. For example, The first five or so columns relate to searching, the next five relate to subsetting, the next few are types of data accessed, etc. Below the table, the minimum and maximum expected number of science users requesting each service is shown. This number is computing by simply summing the number of users requesting each service over all of the scenarios.

The services in the table are defined below. One interesting finding is that most users will require a "match-up" search. This type of search is based on previous results; i.e., the system has some retrieved data or metadata for the user and the user then asks for more information whose data or metadata "matches" the current or selected data or metadata. For example, in most cases, many users will ask for a list of data sets or data products that contain their parameters of interest. When the list is returned to them, they select one of the items and then ask for Guide information for the selected item.

3.2.1 Definitions of User-requested Services

The definitions of the services in the table are as important as the number of science users expected to request them. Thus, the definitions are listed below for the reader to reference in conjunction with Table 3.1. The service definitions are listed in the order in which they appear in the table.

Simple Search	A search based on parameters entered by the user. Multiple data sets and multiple DAACs may be located. Documents may also be located.
Match-up Search	The user already has retrieved data or metadata and then asks for additional data or metadata that matches the previous set. For example, a user first locates a list of data sets which contain his parameters. He next asks for Guide information about those data sets. Or, a user is examining a product and next asks to view the product history.
Coincident Search	The user wants to locate two or more data sets simultaneously that match his criteria.
Simultaneous Multiple DAAC Search	A search is issued that requires the system to search at more than one DAAC or other data center. This takes place either because the user query is very general (i.e., "find me all products containing radiative flux") or because products from one instrument may be located at more than one DAAC.
Save Query Results to file for later use	A user wants granule IDs or other metadata from multiple searches saved to a file so that when he is ready to order, he can retrieve the file and select from it.
Spatial Subsetting	The user does not want data covering the entire area of the globe, but desires data covering some smaller portion of the globe.
Temporal Subsetting	The user does not want all of the data pertaining to his area of interest, but only data within a specified time span.
Parametric Subsetting	The user does not want all of the parameters that make up a product.
Spectral Subsetting	The user does not want all of the spectral bands contained in a product.
Subset QA statistics	The user does not want all of the QA statistics; he wants the statistics covering his time span and area of interest only.
Save Subsetted data for later "bulk" retrieval	The user subsets his data in space, time, etc. and now asks that the data be stored on ECS as a group to be retrieved at a later date.
Save list of lat/long coordinates....	The user subsets a large image into several smaller ones. He would then like to return to the large image to process the data in his areas without having to redraw them.
Access info on non-EOS data	The user wants information (not the data itself) regarding a data product that did not originate from an EOS instrument.
Access info on EOS and non-EOS algorithms	The user wants information (not the algorithms themselves) about algorithms used to produce either an EOS product or a non-EOS product.
Access Electronic Journal	The user wants to access an electronic journal stored on ECS.

Integrated Browse (text)	The user browses textual information interactively (on-line). This information is in the form of documents, guide information, or algorithm descriptions, or information regarding non-EOS data sets.
Cut parts of documents and save to file	The user wants to cut parts of documents and have all of the pieces saved to one file which he can then receive all at once.
FTP Browse	The user wants browse data products delivered non-interactively.
Send Browse Products on medium	The user wants his browse products delivered on a medium.
Integrated Browse (data)	The user wants to browse data while on-line.
Integrated Browse (non-EOS data)	The user wants to browse non-EOS data while on-line.
Display multiple data sets simultaneously	The user wants to view more than one data set at a time.
Animation	The user wants to view several "frames" of data quickly, so that it appears as a "movie loop".
Display "product coverage" map	The user wants to view a map that depicts areas which are covered by his data products of interest.
Ingest user software or file	The user wants the system to accept either a program the user has written or a file containing information to be used when he is accessing the system.
Create and Display 3-D plot	The user specifies data and wishes to view it as a three dimensional plot on-line.
Create and Display X-Y plot	The user specifies data to be used to create an X-Y plot so that he can view it on-line.
Create and Display new images	The user specifies data to be used to create a new image so he may view it on-line.
Create and Display contour plot	The user specifies data to be used to create a contour plot that he may view on-line.
Create and Display scatter plot	The user specifies data to be used to create a scatter plot that he may view on-line.
Manage/Save data created by a user process	The user wants ECS to save data created by any of his processes, whether the data was created with human interaction or not, and manage the data so he may locate it in the future.
Ingest/Archive user results created by processes external to ECS	The user wants ECS to archive results of his research for use by others.

Trigger process when log-on occurs	The user wants a process to take place automatically when he logs onto the system.
Access Level 0 data	The user wishes that Level 0 data be accessible by himself and/or his process (software).
Access orbital Model output	The user wishes to know when the instruments will taking future data over his area of interest.
Access data dependency info	The user wishes to retrieve a list of data products that were used as inputs to the products he is interested in.
Automatic Notification	The user wishes to receive a message at his facility when certain conditions exist.
Statistical Analysis	The user wishes to perform statistical analysis on data while on-line.
Regrid data	The user would like the data to be recalculated to conform to a grid cell size larger than the current cell size.
Coordinate transformation	The user would like to view or receive the data in a coordinate system other than the one the data currently exist in.
Compute difference between two parameters	The user specifies two parameters and would like the system to compute the difference between them.
Compute ratio of two parameters	The user specifies two parameters and would like the system to compute the ratio of one to the other.
Interactive download	The user wants the data he specifies to be sent to his machine and stored on his local disk while on-line.
Point Instrument	The user would like an instrument to be pointed at his area of interest at a time he specifies.
Video Teleconferencing	A user wishes to confer with his colleagues while they are all on-line. All should see the same information on their monitors at the same time.
Compute order cost	The user would like to know the cost of the order before final order submission.
Order from a saved results list or file:	The user would like his saved list to be displayed so that he may select products from it while he is ordering. Or, the user would like the system to look in a file where he has predefined the products of interest, the geographic area, the temporal coverage and other required ordering information.
Standing Order	The user would like to receive regular shipments of data by submitting only one order. The shipments are sent automatically (does not require action on his part) either at regular intervals or as available.
Order results of a user process run on ECS	The user orders data that has been created by his uploaded software using ECS processing power.

Table 3.1 User-requested ECS services based on 27 science user scenarios.

Scenario No.	Minimum Number of Users	Maximum Number of Users	Simple Search	Match-up Search	Coincident Search	Simultaneous Multiple DAAC search
1	16	29	X			
2	81	146	X	X		
3	16	29	X	X		X
4	25	45	X	X	X	X
5	121	218	X			
6	1000	1800	X	X		X
7	500	900	X	X		
8	700	1260	X	X		X
9	331	596	X	X		X
10A	750	1350	X	X		X
10B	750	1350	X			
11A	167	300	X	X		X
11B	167	300	X	X		X
11C	167	300	X	X		X
12	700	1260	X	X		X
13	274	494	X			
14	700	1260	X			
15	400	720	X	X		
16	1075	1935	X			X
18	581	1046	X			X
19	169	305	X	X		X
20	500	900		X	X	X
22A	12	22	X			
22B	12	22	X			
23A	145	261	X			
23B	145	261	X	X		X
24	400	720				

Minimum Number of Science Users Requesting Service	8907	5737	525	6493
Maximum Number of Science Users Requesting Service	16209	10472	945	11687

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Save Query results to file for later access	Spatial Subsetting	Temporal Subsetting	Parametric Subsetting
1	16	29	X			
2	81	146		X	X	X
3	16	29		X		
4	25	45	X			X
5	121	218				
6	1000	1800		X	X	X
7	500	900	X	X	X	
8	700	1260			X	X
9	331	596	X			
10A	750	1350	X	X	X	X
10B	750	1350		X	X	X
11A	167	300		X	X	
11B	167	300		X	X	
11C	167	300		X		X
12	700	1260		X	X	X
13	274	494		X	X	X
14	700	1260	X	X	X	
15	400	720		X	X	X
16	1075	1935		X	X	X
18	581	1046		X	X	X
19	169	305		X	X	X
20	500	900		X	X	X
22A	12	22		X	X	X
22B	12	22		X	X	X
23A	145	261		X		X
23B	145	261	X	X	X	X
24	400	720		X		X

Minimum Number of Science Users Requesting Service	2451	8630	8602	7805
Maximum Number of Science Users Requesting Service	4441	15681	15631	14197

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Spectral Subsetting	Subset QA stats	Save Subsetted data for later "bulk" retrieval	Save List of lat/long coordinates used in subsetting to file for continued re-use
1	16	29	X			
2	81	146				
3	16	29				
4	25	45				
5	121	218				
6	1000	1800				
7	500	900				
8	700	1260		X		
9	331	596				
10A	750	1350				
10B	750	1350			X	
11A	167	300				
11B	167	300				
11C	167	300				
12	700	1260				
13	274	494				
14	700	1260	X			X
15	400	720				
16	1075	1935				
18	581	1046				
19	169	305				
20	500	900				
22A	12	22	X			
22B	12	22				
23A	145	261				
23B	145	261				
24	400	720				

Minimum Number of Science Users Requesting Service	712	700	750	700
Maximum Number of Science Users Requesting Service	1311	1260	1350	1260

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Access info on non-EOS data	Access Non-EOS data	Access Data at non-US site	Access Info on EOS and non-EOS Algorithms	Access Electronic Journal
1	16	29	X			X	X
2	81	146					
3	16	29	X	X			
4	25	45	X			X	
5	121	218					X
6	1000	1800					
7	500	900		X			
8	700	1260				X	
9	331	596				X	
10A	750	1350	X				
10B	750	1350		X			
11A	167	300					
11B	167	300				X	
11C	167	300				X	
12	700	1260					
13	274	494				X	
14	700	1260					
15	400	720		X		X	
16	1075	1935					
18	581	1046					
19	169	305		X			
20	500	900		X			
22A	12	22					
22B	12	22		X			
23A	145	261		X			
23B	145	261		X	X		
24	400	720		X	X	X	

Minimum Number of Science Users Requesting Service	791	3037	545	2464	121
Maximum Number of Science Users Requesting Service	1453	5468	981	4464	247

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Integrated Browse (text)	Cut parts of documents and save to File	FTP Browse	Send Browse Products on Medium
1	16	29	X			
2	81	146	X			
3	16	29	X			
4	25	45	X			
5	121	218	X			
6	1000	1800	X			
7	500	900	X			
8	700	1260	X			
9	331	596	X			
10A	750	1350				
10B	750	1350	X			
11A	167	300				
11B	167	300	X			
11C	167	300	X		X	
12	700	1260				
13	274	494	X	X		
14	700	1260				
15	400	720	X			
16	1075	1935				
18	581	1046				
19	169	305				
20	500	900	X			
22A	12	22				
22B	12	22				
23A	145	261				
23B	145	261			X	X
24	400	720	X			

Minimum Number of Science Users Requesting Service	5351	274	312	145
Maximum Number of Science Users Requesting Service	9807	494	561	261

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Integrated Browse (data)	Browse Non-EOS data	Display multiple Data sets simultaneously	Animation
1	16	29				
2	81	146				
3	16	29				
4	25	45				
5	121	218				
6	1000	1800				
7	500	900	X	X		
8	700	1260	X			
9	331	596				
10A	750	1350	X			
10B	750	1350	X			
11A	167	300	X			
11B	167	300				
11C	167	300	X			
12	700	1260	X			
13	274	494	X			
14	700	1260	X	X		X
15	400	720	X	X	X	X
16	1075	1935	X			
18	581	1046				
19	169	305	X			
20	500	900				
22A	12	22	X			
22B	12	22	X			
23A	145	261				
23B	145	261				
24	400	720				

Minimum Number of Science Users Requesting Service	6376	1600	400	1100
Maximum Number of Science Users Requesting Service	11478	2880	720	1980

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Display "product coverage" map	Ingest User Software or file	Create and Display 3-D plot	Create and Display X-Y plot	Create and Display New Images
1	16	29					
2	81	146					
3	16	29					
4	25	45					
5	121	218					
6	1000	1800					
7	500	900					
8	700	1260					
9	331	596					
10A	750	1350					
10B	750	1350					
11A	167	300					
11B	167	300					
11C	167	300					
12	700	1260					
13	274	494				X	X
14	700	1260		X			X
15	400	720					
16	1075	1935		X			
18	581	1046	X				
19	169	305		X			
20	500	900					
22A	12	22		X		X	
22B	12	22		X			
23A	145	261		X			
23B	145	261		X			
24	400	720					

Minimum Number of Science Users Requesting Service	581	2258	1075	286	974
Maximum Number of Science Users Requesting Service	1046	4066	1935	516	1754

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Create and Display Contour Plot	Create and Display Scatter Plot	Manage/Save data created by user process	Ingest and archive user results produced externally to ECS
1	16	29				
2	81	146				
3	16	29				
4	25	45				
5	121	218				
6	1000	1800				
7	500	900				
8	700	1260				
9	331	596				
10A	750	1350				
10B	750	1350				
11A	167	300				
11B	167	300				
11C	167	300				
12	700	1260				
13	274	494				
14	700	1260			X	
15	400	720	X			
16	1075	1935			X	X
18	581	1046			X	X
19	169	305			X	
20	500	900		X		X
22A	12	22			X	
22B	12	22				
23A	145	261				
23B	145	261				
24	400	720				

Minimum Number of Science Users Requesting Service	400	500	2537	2156
Maximum Number of Science Users Requesting Service	720	900	4568	3881

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Trigger process when log-on occurs	Access Level 0 data	Access Orbital Model Output	Access Data Dependency Info
1	16	29				
2	81	146				
3	16	29				
4	25	45				
5	121	218				
6	1000	1800				
7	500	900				
8	700	1260				
9	331	596				
10A	750	1350				
10B	750	1350				
11A	167	300				
11B	167	300				
11C	167	300				
12	700	1260				
13	274	494				
14	700	1260				
15	400	720	X			X
16	1075	1935				
18	581	1046				
19	169	305				
20	500	900				
22A	12	22		X		
22B	12	22			X	
23A	145	261				
23B	145	261				
24	400	720				

Minimum Number of Science Users Requesting Service	400	12	12	400
Maximum Number of Science Users Requesting Service	720	22	22	720

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Automatic Notification	Statistical Analysis	Regrid Data	Coordinate Transformation
1	16	29				
2	81	146				
3	16	29				
4	25	45				
5	121	218				
6	1000	1800				
7	500	900				
8	700	1260				
9	331	596		X		
10A	750	1350				
10B	750	1350				
11A	167	300				
11B	167	300				
11C	167	300				
12	700	1260				
13	274	494		X		X
14	700	1260		X		
15	400	720				
16	1075	1935				
18	581	1046				
19	169	305				
20	500	900			X	
22A	12	22	X			
22B	12	22	X			
23A	145	261				
23B	145	261				
24	400	720				

Minimum Number of Science Users Requesting Service	24	1305	500	274
Maximum Number of Science Users Requesting Service	44	2350	900	494

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Compute Difference of Two Parameters	Compute Ratio of Two Parameters	Interactive Download	Point Instrument
1	16	29				
2	81	146				
3	16	29				
4	25	45				
5	121	218			X	
6	1000	1800				
7	500	900				
8	700	1260				
9	331	596				
10A	750	1350				
10B	750	1350				X
11A	167	300				
11B	167	300				
11C	167	300				
12	700	1260				
13	274	494	X			
14	700	1260	X	X		
15	400	720				
16	1075	1935				
18	581	1046				
19	169	305				
20	500	900				
22A	12	22				X
22B	12	22			X	X
23A	145	261				
23B	145	261				
24	400	720				

Minimum Number of Science Users Requesting Service	974	700	133	774
Maximum Number of Science Users Requesting Service	1754	1260	240	1394

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Video Teleconferencing	Compute Order Cost	Order From a saved results list or a file	Standing Order
1	16	29		X	X	
2	81	146		X		
3	16	29		X		
4	25	45			X	
5	121	218				
6	1000	1800				X
7	500	900			X	X
8	700	1260				X
9	331	596				
10A	750	1350	X			X
10B	750	1350				X
11A	167	300				
11B	167	300				
11C	167	300				
12	700	1260				
13	274	494				
14	700	1260				
15	400	720				X
16	1075	1935				
18	581	1046				
19	169	305				
20	500	900				X
22A	12	22			X	X
22B	12	22			X	
23A	145	261				X
23B	145	261				
24	400	720				X

Minimum Number of Science Users Requesting Service	750	16	549	5157
Maximum Number of Science Users Requesting Service	1350	204	1018	9283

Table 3.1 Continued

Scenario No.	Minimum Number of Users	Maximum Number of Users	Order results of User process run on ECS
1	16	29	
2	81	146	
3	16	29	
4	25	45	
5	121	218	
6	1000	1800	
7	500	900	
8	700	1260	
9	331	596	
10A	750	1350	
10B	750	1350	
11A	167	300	
11B	167	300	
11C	167	300	
12	700	1260	
13	274	494	
14	700	1260	
15	400	720	
16	1075	1935	X
18	581	1046	
19	169	305	X
20	500	900	
22A	12	22	
22B	12	22	
23A	145	261	
23B	145	261	
24	400	720	

Minimum Number of Science Users Requesting Service	1244
Maximum Number of Science Users Requesting Service	2240

3.3 Analysis of High-Level Functions and User Comments

This section allocates recommended requirements from the scenarios to either a high-level functional category or to a section on user comments. Each high-level function contains several facets of that function. User comments and suggestions speak to various functions and therefore have been separated into more specific or related functional groups.

3.3.1 Processing

Many recommendations/user needs identified relating to the *processing* function cross over into *policy* implications. These processing issues can also be listed as policy issues because they involve compromises with scientists and developers, such as the allocation of fixed resources (i.e. disk space, processing CPU, etc.).

The SDS provides for "user-supplied processing methods" as a Trade Study (page 4-392), with results scheduled for the Critical Design Review (CDR). Many of the recommendations identified by users fall into this category, as they desire processing within ECS that is beyond the area of basic product generation. They often have to do with product refinement outside of Level 0 to Level 4, and in some cases they have to do with ECS performing tasks such as coarse data screening in an automated fashion with little or no user involvement on a regular basis.

The recommendations in this area often express an understandable desire on the part of users to increase ECS's responsibility in supporting user research to the maximum MTPE-approved extent, both in processing resource provision and in storage/archiving. The recommendations therefore go beyond traditional earth science product generation into areas by which data products may be further manipulated to make them more useful.

It is ECS's function to support basic product generation and earth science data access. At some point beyond that, a line exists which separates basic, traditional product generation from processing performable by users' Science Computing Facility (SCF) resources. The exact placement of that line will determine our reaction to these user recommendations to a significant degree.

3.3.1.1 Processing and reprocessing beyond that provided by ECS standard products

The Mark Abbott recommendation (#522) raises the issue that the users of ECS will definitely ask the system to do processing and reprocessing which is beyond that provided by ECS standard products. Estimates of system loads and performance should indeed incorporate products beyond the current standard product list. Therefore this recommendation can be listed as matching the existing requirements, PGS-1310, a 20% growth rate requirement and PGS-1300 which addresses prototype products. In addition, this concern will be addressed in the performance modeling activity.

3.3.1.2 Use of ECS processing for user-supplied special methods

Other processing concerns address whether ECS should allow users to construct code using results from regressions trees for application to whole images (#620) and/or allow users to run Image Display Language (IDL) code on sub-images (#621) both of which were raised in scenario 14 by Walter Rosenthal. Specifically, the user would like to construct code based on the results of regression trees that would allow him to embed a "snow amount" function into the ECS DBMS. He (and other users) could then invoke this function to produce images which contain the per cent of snow cover of each pixel. While it is agreed that ECS can supply data for this to be performed at the SCF, this user would like to do the processing using ECS processing resources. The

User-Supplied Methods Trade Study will analyze the impact of this recommendation. This recommendation will be re-examined in the CDR time frame

3.3.1.3 Data access, processing capabilities, etc. without data delivery

Users want data access, manipulation, and processing capabilities, while not being forced to receive this data on their home systems (Raul Lopez, scenario 15, #523). This recommendation does not completely match current requirements. The thrust of this item is that users want to be able to access and process ECS-resident data while minimizing the processing and storage resources required to be supplied by themselves, or even while using a dumb terminal.

At present, the response from ECS is that users can view data outside of special approval only through an ECS Client Subsystem service or Application Program Interface (API). This implies a certain, fairly sophisticated, level of resources basically to be user-provided. There is a requirement that the ECS support dumb terminal access, but the level of support for this may be directed toward occasional users, and hence not be satisfactory to earth science researchers.

On the other hand, users who may not have large storage capacities may see ECS ingest capabilities as an opportunity to store and distribute data for their and others use. (James Hannawald, scenario 18, #529). The GSFC project office and NASA HQ will help to identify the datasets that will be ingested and archived by ECS, together with the appropriate approval process.

To summarize the general thrust of these recommendations, users desire to maximize the use to which they may put ECS processing and storage/archiving resources. They desire to be able to access, view, manipulate, and store data without committing resources, if this is within the bounds of ECS responsibility. The outcome of policy decisions regarding user-supplied processing methods will affect our final response to these recommendations.

Additionally, local DAAC policy may be a factor. ECS service to terminals that do not load the Client subsystem (dumb terminals and small processors) will probably be extended via DAAC-resident client software administered under the control of local DAAC management. Therefore, DAAC policy makers will influence the service extended to those who make use of this software, which presumably includes some of the proponents of the above stated recommendations.

3.3.2 Searching/Subsetting/Ordering

3.3.2.1 Simultaneous searches for groups of related data products or parameters

Because of the time involved, the method of searching may often be as important to the researcher as the data which they are seeking. A researcher in a hydrologic modeling effort (scenario 10a, Ted Engman, #626) wishes to search for groups of related data products and/or parameters for base mapping purposes. For example, the user would like to enter "flood plain extent", "stream channels" and "drainage basin boundaries" as parameters and receive a list of products that contain at least one of these parameters. This type of search functionality will be supported by ECS. However, in the area of base mapping data, ECS will archive only large-scale features such as land/water boundaries, major rivers, and political boundaries.

This same user scenario asks for ECS to provide capability to select several data products from a results list and to search for QA statistics for all selected products simultaneously. The expected results would be one list of

QA statistics from which the user would select particular items for display. The particular aspect of this recommendation which is important to consider is that users may not progress through a series of steps for each data set, but rather do one step on several data sets and then move on to the next set of data sets. The thrust of this recommendation is an implementation detail of the current SDS Client Support Services (SDS, section 4.5.1.3.2.5). "Interactions between a client and a service provider can be conducted in the context of a session. ... the session will maintain a memory of the requests issued in the session as well as their current status, have knowledge of currently allocated or consumed resources, and permit the client and service provider to control those resources".

3.3.2.2 Retention of search and order criteria

The issue of whether the ECS Architecture should retain search criteria is raised by Raul Lopez in scenario 15 (#610), which presents a very detailed look at search and manipulation of retrieved data for ordering purposes. First, the recommendation asks for the ability of the system to "remember" the search criteria and order parameters the user has previously used . This part of the recommendation should be answered with the proviso that the amount of hardware provided for ECS will not increase beyond the resource envelope allocated to this functionality. In SDPS-0095, the requirement states that ECS will "... provide user interfaces that are individually tailorable including settable preferences, user defined keywords, query save capabilities, and screen layout preferences." This matches several other existing requirements such as IMS-0120i, IMS-0140, and IMS-0680, and repeats a similar desire expressed in other RRDB items, such as record #538, "...inconvenient to always have to specify search criteria when it can be extracted from context." The user wants to minimize the amount of data to be entered by the user in situations where the required parameters can already be determined from the context.

These items are also addressed in the SDS and will be implemented. The necessary storage may be required to be supported by the user’s facility. The desire for minimizing required search criteria and performing sanity checks, tailoring them on an instrument by instrument basis, is widely held, and is to be implemented in ECS.

3.3.2.3 One request data ordering for past and future data

In the last part of the recommendation by Raul Lopez (scenario 15), the user wants to rely on the system to "remember" the order parameters. This segment of the user's recommendation can be binned with another one of his requests specifically asking that ECS provide the capability to order data for past and future data with one request (#609). This is an implementation detail, specifying a characteristic of the product search and order facility. Accepting this recommendation would provide an understandable convenience, but the user must be made aware of the risks associated with using data that has not been assessed for quality.

The object oriented ECS architecture portrayed in the SDS will be able to accommodate this request efficiently. It is more of an implementation detail than a requirement, and is not necessarily the responsibility of the ECS data ordering facility. The question of whether or not additional user-provided application software will be needed is not yet known. The ultimate disposition of this recommendation will await finalization of the ordering capability to be provided by ECS.

3.3.2.4 Data Subsetting

Scenarios repeatedly identify several requirements for the function of data subsetting by parameter, by combination of parameters, or by any layer of the data pyramid. In scenario 10b (#602b), Bruce Wielicki wants to be able to subset data for many different products from any of the following instruments: CERES, MISR, and ASTER. He hopes to be able to place a standing order for only those scenes over a particular latitude and longitude for specific products. This matches a requirement currently in Scenario 2 of the SDS (section 4.6.3.2). Table 3.2 lists representative scenarios that match existing subsetting requirements.

Table 3.2 Representative scenarios whose data subsetting requirements match existing requirements

There are several requirements in the F&PRS document that relate to subsetting and subsampling. Each DADS "...shall support the capability for subsetting, and subsampling data products ordered via the IMS", "...shall

Scenario	Author	Subsetting Requirement
2	Ronald Holle	Subsetting based on parameter
13	Bruce Barkstrom	Subsetting any layer of the data pyramid using the manipulate service
20	Eric Barron	Retrieval of both subsetted and processed data

provide the capability to subset, subsample, or average data within a granule based on defined criteria to include geographic location (x, y, z) (spatial with rectangular boundaries)...", and "...shall provide tools to the users to perform ... subsetting, ... and subsampling." Requirements from the IMS give in even more detail, specific criteria that fulfill these scenarios' requests.

The SDS also contains extensive text about granule subsetting. Sections 4.4.2.2, 4.4.3.5, 4.4.3.7, 4.5.4.3 and 4.5.4.3.1, as well as Scenario 2, provide details, using the example of spatial subsetting. ECS will support this functionality, but the limiting factor may be in the original construction and format of the target data products (as archived), not in ECS capabilities. The subject of subsetting by parameter is directly addressed in section 4.4.3.7 of the SDS, which states, "...subsetting is called for across any of these axes, (i.e. by region, by parameter, by level) or for combinations (e.g. one parameter within one region). Note that this statement also satisfies the Barkstrom requirement of subsetting on all layers of the Data Pyramid.

The Walter Rosenthal (scenario 14) requirement (find the brightest pixel in a Landsat scene) is not specifically addressed but it may fall into the category of a content-based search. Content-based searching of metadata is discussed in the SDS (section 4.5.1.3.2.5). If the metadata contains this information then the requirement is satisfied; otherwise, the outcome of this requirement may be dependent upon the results of both the User-Supplied Methods Trade Study and the Science Software Direct Access to Data Server Trade Study.

3.3.2.5 User field terminal acts as temporary SCF and has priority for receiving data

Two additional items which currently fall under the implementation detail status of user interface involve user field terminals in scenario 10b (#605). The first request asks that ECS allow the user field terminal to act as a temporary SCF, then wants the field terminal to have priority for receiving data (#616). As SCFs can be located relatively anywhere, the only limitations to the first part of this request exist in the actual hardware-related limitations, which may not be a factor. Additional analysis of the second part of the request should provide further detail related to the criteria on which 'priority' would be judged. This will be re-examined at the Preliminary Design Review (PDR).

3.3.2.6 Verification of products ordered

The user interface category also encompasses those functions within the ECS architecture that help the user to use the ECS more efficiently. A requirement in scenarios 2 and 13 (#627) suggests the provision for users to obtain a cost estimate for products ordered and allow the user to cancel the order if needed. A similar but more system-level verification asks that the ECS Architecture determine user hardware / software capabilities before sending a full browse image to user's machine in order to ensure that the product format is consistent with the recipient's capability.

3.3.2.7 Standing orders on documents as well as data

Another architecture requirement from scenario 5 (Jeff Dozier) recommends that ECS provide the capability to issue standing orders for documents as well as data (#613). For example, a user would place a standing order to receive documents that contain user specified character strings and/or keywords. This capability is provided for in the latest architecture documentation, and has therefore been accepted.

3.3.3   Storage/ Archive

Storage and archiving capabilities are crucial parts of the overall system. There are several types of storage/archive issues. For example, one issue involves what types of information should be stored about the data products (e.g., production histories, QA statistics, etc.). A separate, but related issue concerns which users will be permitted to use the ECS storage (either temporary or permanent) facilities and for what purposes. For example, one of the user scenarios requests that data he receives in the field also be stored on the ECS together as a group so that when he returns to his home facility, he may access this customized collection of data products and download it without having to reassemble the collection. The specific requirements are detailed below.

3.3.3.1 Historical accounting of all data

The methods by which data are collected, derived, and processed is of great concern to researchers. The need for historical accounting of all data (comment by Mark Abbott, #524) reiterates the requirement calling for the IMS to provide the capability to search a product's processing history (IMS-0545). The SDS provides a description of production history as part of the data pyramid. For information regarding the data production history object within the client subsystem, see section 4.5.1.2.1 of the SDS.

3.3.3.2 Sending standing orders to a temporary storage space on EOSDIS

Scenario 10b (Bruce Wielicki, #615) expresses the desire to have standing orders sent to a temporary storage space within EOSDIS so that it can be accessed, browsed, and then selectively transferred by a high data rate transfer of one megabyte (MB) per second to a workstation in the field. Also, the data should be stored in that temporary storage space until the end of the field investigation. When the scientist returns to his home institution he can then transfer all of the data as a group from temporary storage within EOSDIS to his site. This capability may be an implementation detail due to both cost and security issues but is within the scope of the ECS project. Presuming that the amount of storage required is not beyond the available resource envelope and would not adversely influence the sizing of the DADS archives, then ECS should support this function. However, only Instrument Principal Investigators (PIs) and Interdisciplinary PIs will have remote terminal privileges. Therefore, the use of a remote terminal is already limited to these users. Another concern in this request relates to the "high data rate transfer of one MB per second". Projections of future capabilities of the Internet or its successor, and the associated cost of data transfer need to be estimated to better understand capabilities that will realistically be available to users.

3.3.3.3 Storage of processed data for use by other users

Archival or storage of non-standard data products highlights a concern about whether to allow this data to be stored on the ECS system for use by other users. Eric Barron, in scenario 8 (#637), recommends that if a user produces a (non-standard) data product, he or she should then be able to upload the processed data to ECS so that other interested users may access it. Although this recommendation currently represents a design issue, the ECS Architecture Team is paving the way for SCF-located products to be advertised and accessible. As a design issue, this user recommendation is still being analyzed examined by developers to determine if it is within the resource envelope.

3.3.4 Visualization Utilities/Tools

Based on the collection of scenarios, users have identified several visualization utilities that would be advantageous to their research. These tools include movie-loops, interactive video, telecasting, and teleconferencing.

The SDS identifies visualization software as subject for a trade study (page 4-389). Clearly stated in that section is the assessment that “EOS should provide just minimal visualization and analysis in EOS developed software...” Results of this trade study are due at the PDR. Therefore, any visualization functionality beyond basic browse product visualization will probably be the responsibility of a user-provided application package, with ECS responsible for the API needed to facilitate the product’s ECS interface to the Graphical User Interface (GUI) and data product access as required.

3.3.4.1 Visualization technologies (interactive video, telecasting, and teleconferencing)

Researchers see the need for a system that encourages collaboration and therefore have requested various technologies that would make this easier (#525). Mark Abbott suggests both video teleconferencing or telecasting as functions to be supported by ECS to encourage collaboration. Ted Engman (scenario 10a) suggests that if available, he would use real time interactive video on his workstation so that he could collaborate with his colleagues at other institutions. This video or movie-loop would run concurrently on several users' machines during a telecast or conference, and allow the conferees to have an interactive capability to point at the interactive video during display. Because of the uncertainty of communications capabilities and cost, this record is statused as a design issue and scheduled for re-examination in 1995.

It would seem that ECS would probably be required to support this from a communications protocol aspect only. However, architecturally the wide-band video required for this capability with the much increased amount of data, impacts the sizing of archives and the cost of basic visualization requirements. The example of simultaneous interactive "real-time" cursors would require more data links with CSMS impacts to "who provides the equipment" if not already provided within workstation. However, the animation (or movie-looping) capability will be a part of the application tools (SDS). These "tools install as 'desktop application tool objects' into the ECS desktop document objects using..." the specific services. (SDS, section 4.5.1.3.2.1)

The subject of collaboration, especially including videoconferencing, is covered several times in the SDS. While the particulars of presentation to the user may be the responsibility of the user's application, ECS must bear the responsibility of providing underlying support to allow users to view each other and to view objects in a common mode. (See SDS sections 4.5.1.3.2.3 and 4.11.2.1.) The SDS views video conferencing and movie-looping as an evolvability issue. Important work on standards, especially compression standards, is still in progress, making it unattractive for ECS to develop tools providing these features. This will probably be an area for user-supplied application software, with ECS-developed APIs needed to enhance the utility of the applications in standard ECS-user collaboration environments.

3.3.4.2 Visualization technologies (movie-looping)

Similarly, but representing greater detail, Raul Lopez in scenario 15 (#607) requested a detailed 4-mode movie-loop capability. Simple movie loops with three or four modes (step forward, continuous forward, etc.) are currently available and there is an ECS requirement (IMS-1530) which lists the capability for "...visualization of data in raster or vector data products and visualization of animated products". The extension of this requirement for detailed capabilities may occur as long as ECS retains, at least to some degree the right to determine the level of support (the COTS package ECS will provide, level of functionality, etc.). However, as an issue to be further analyzed, this level of support will be refined by both system developers and users. The particular details provided seem to be implementation details. Visualization animation / movie-looping is expected to be implemented in later system releases and will not be a capability of Release A.

Again, from scenario 15, the author, Raul Lopez, asks that the ECS Architecture provide for multiple non-overlapping windows capable of displaying synchronized movie-loops. This provision goes beyond the requirement for basic visualization. It requires a potentially extensive amount of processing to synchronize diverse products. Software required for this functionality is complex and its cost to the ECS project may be too great with current technology. The Screening Team proposes that any ECS requirement for visualization should extend only to basic browse, observation, QA, etc. (see also the SDS, page 4-389). Utilities needed for in-depth research should be provided by the user with his own resources.

Scenario 15 by Raul Lopez (#612) identifies another recommendation that is evolutionary in scope and yet is also related to the movie-loop capability. He requests the ECS Architecture provide an EOSDIS interface to view non-EOS data in movie-loop format. This user would like to be able to access data from the National Lightning Detection Network (archived at the MSFC DAAC), and view that data in movie-loop format through the EOSDIS interface. As long as all policy approvals are in place for the access of non-EOS data, the true issue in this recommendation becomes the capability of movie-loop format.

3.3.4.3 Unique zoom capabilities

Scenario 15 (Raul Lopez, #642) requires that ECS provide a unique zoom capability to aid in the researcher's analysis process. While displaying a contour plot, the user would like to draw a polygon to enclose an area to zoom in on. However, when he zooms in, he would like the system to display the actual Level 1B data at full resolution from which the contour plot was produced (he does not want a zoomed contour plot). Although IMS-1550 provides for basic zoom capabilities, this includes zoomed pictures with the same pixel map, not a zoomed picture that calls up another finer pixel picture. This would require extensive calculations (code) to switch to data products of finer pixels automatically. This requirement is undergoing analysis and needs further review but seems to be an evolutionary feature of the ECS system, especially, as far as drawing from a different set of data when the zoom is performed. This also may be a functionality that would be better implemented by user-provided software.

3.3.4.4 Graphical display of QA data for a given area

Graphical display of QA data for a given area (#604) provides yet another example of a visualization utility that the user, James Stobie, in scenario 12, requests to make his analysis more efficient. This recommendation is an implementation detail relating to IMS-1520a. This refers to a desire to see a graph of QA data vs. time for each piece of data. Essentially, this would yield a graph of QA data vs. space within the data product. ECS plans to support these capabilities.

3.3.5 APIs

Application Program Interfaces (APIs) provide a set of calling conventions defining how a service is invoked through a software package. This interoperability makes it easier for a user to call up his application program on his ECS client, creating standardized interfaces between scientist and ECS. The SDS discusses APIs at length.

It is not yet clear that ECS will copy a user's system's "look and feel" because a trade study will determine the method by which ECS will coexist with the system's GUI (see SDS page 4-388). What is clear is that ECS will provide APIs that will standardize and facilitate interoperation between the user's applications and ECS services such as data ordering and receipt, browse, and data access.

3.3.5.1 User-defined statistical packages

Scenario 14 by Walter Rosenthal wants the ECS architecture to support the ability to use user- defined statistical packages. Though ECS will not provide sophisticated statistical packages on-line, ECS will not limit the use of user-defined statistical packages and will allow users to export ECS data in formats ingestable by statistical systems on their home systems (SDS, section 4.5.1.3.1.4).

3.3.5.2 Interoperability with statistical packages and DBMSs

As a comment, Jeff Dozier cites the need for interoperability with standard statistical packages and database management systems (DBMSs). Existing requirements meet this recommendation for statistical packages and DBMSs. It is the intent to provide support for all popularly-used packages. Similarly, scenario 14 by Walter Rosenthal issues an even more specific request for DBMSs for sub-image tracking (#633). ECS will provide base data with the user being responsible for specific sub-image tracking. In the Client Subsystem section (4.5.1) of the current SDS document, the components provided include the "...services needed to interface an application with ECS. Accessed services can be remote ... and local (e.g., to a database manager at the user's site.)" (SDS, section 4.5.1), Again, though ECS will provide only limited DBMSs on-line, ECS will not limit the use of user-defined DBMSs at the user's site, and will provide the APIs, objects, and services needed to facilitate data and metadata transfer into the user-provided application.

3.3.5.3 Support of customized user applications via the ECS APIs

Recommendations for requirements for ECS to support APIs developed by users (#622, #644, #602) cut across several classes within the status rankings because of the details of each request. In scenario 22b (Bryan Isacks), the user wants to be able to submit his own software so that it can monitor specific datasets and alert the user when specific data parameters exceed a user-supplied threshold value. The software would run concurrently in the background, thus eliminating the need to constantly monitor the system with human intervention. Another user scenario (Luke Flynn, scenario 22a) has requested the capability to monitor the Level 0 MODIS data stream through ECS employing user-developed software. Both requests remain as design issues in order to evaluate those applications' needs against the APIs which are feasible to provide. Policy is needed for users that want to create background programs that continually check datasets for threshold conditions and other objective characteristics. This is to be addressed in the trade study on User-Supplied Processing, discussed above, and also discussed in the SDS (page 4-392).

Currently, the ECS architecture plan (SDS) does not explicitly provide for this type of monitoring capability within ECS. However, this requirement could become part of the ingest functionality. ECS will provide APIs which will facilitate the ordering and receipt of data products so that this analysis may be conducted in the user’s facility (the SCF). However, these two recommendations seem to imply a request that the analysis be conducted within the ECS, with the user simply providing and administering the program.

3.3.5.4 Uploading of user-developed data processing algorithms

A user interface requested in scenario 16 by Leonard Walstad, asks that ECS provide capability to upload user developed data processing algorithms (#639). The scientist would like to be able to ingest his own simple algorithms into EOSDIS and run them in order to reduce data, or do limited analysis, before ever receiving the data at his home institution.

Because of the desire for data manipulation as opposed to just data access, this request resides as an implementation detail. However, our current thrust of the Client Subsystem design in the SDS allows for the user to provide COTS software, and ECS will provide an extensive library of APIs to facilitate the interaction of these with ECS-resident data. This would take place in the user’s facility, requiring him to provide temporary storage, and processing. The outcome of the trade studies on user-supplied processing methods and science software direct access to the data server may provide alternatives allowing more of this process to take place within ECS.

3.3.5.5 Data Acquisition Requests (DARs) and data orders when specific events occur

When specific data parameters exceed user-defined thresholds, the user wants to be notified by the ECS in response to that "event". First, the user wants a message automatically sent to him at his SCF saying that his detection conditions have been met (scenario 22b, Bryan Isacks; scenario 22a, Luke Flynn, #602). Both of these scenarios contain the possibility of the users submitting a Data Acquisition Request (or DAR) requesting that the ASTER instrument be pointed at the area of interest, if possible. Both scenarios may also submit files containing a list of data products to be sent to them for a specified period of time.

In addition, user scenario 22a also wants ECS to append information to an "alarm history" file each time the monitoring software detects conditions that signal a possible "event" (#645). This detection involves very simple processing, a basic quantitative comparison between fields in the Level 0 data stream and a user-defined threshold value. Since no significant processing and no product generation is involved, ECS will be able to perform this service relatively easily. The limitation may be the time at which the data appears in ECS (from EDOS), which may approach 24 hours. Users desiring a short time span between observation and reception at their facilities may have to find other avenues. The monitoring activity of scenario 22b is more complex and involves monitoring non-EOS data sets. Monitoring of non-EOS data in a near-real time mode raises the issues as to whether users would be given this capability through EOSDIS or through other systems.

3.3.5.6 Access links for user workstations to obtain large volumes of data with low-level tools

A final issue related to interoperability comes from Eric Barron in scenario 20 (#636) which states that scientists will more than likely "grab" data from EOSDIS and take it back to try to process it locally. To accomplish this, hooks or access links between ECS and the scientist's desktop hardware should be developed so that low-level tools can access large volumes of data. This recommendation should be further detailed and examined to determine the capabilities of "low level tools" and what type of interfaces would be required to support these. However, the current architecture does support the capability of downloading data from ECS via APIs to be processed at the user's site.

3.3.6 Access of Static Ancillary Data - Internal and External

3.3.6.1 Access to GIS-related products through EOSDIS

Access to static ancillary data, both internal and external to EOSDIS, encompasses several user scenario requests. An example of this is architectural support of Geographic Information System (GIS) -related products through EOSDIS (scenario 16old, #625). Although evolutionary in scope, information and data stored in ECS will be available for downloading for use by user-provided GIS software. Though GIS software resident within ECS is not currently within scope, the ECS plans to support translation to a set of formats which are to be determined based on user needs. In the GIS area, ECS plans to support translation to the GIS format specified by the Spatial Data Transfer Standard (SDTS) profiles and data will be downloadable to GIS packages resident in the scientist's home institution. See SDS Scenario #1, section 4.6.3.1, step 11, where access to data in GIS formats is depicted.

3.3.6.2 Graphical displays and provision of GIS file of Instrument Ground Track Swaths

Provision of ECS capability to graphically display and provide GIS file of Instrument Ground Track Swaths for a requested timeframe (#629) presents an interesting implementation detail from scenario 22b (Bryan Isacks). Users want a graphical display and GIS input files of potential areas of observation of high resolution imagery during the timeframe in question. ECS plans to provide graphical displays of orbital paths, most likely with ground track swaths included. Limited GIS capability for visualization may be provided.

3.3.6.3 Results of orbital prediction models to user and user processes

Access to an orbital prediction model to both users and user processes (scenario 23b, Michael Goodman, #630) is a requirement that will be provided to authorized users for visualization and planning purposes.

3.3.6.4 Access to static ancillary data

Design issues under consideration involve access to static ancillary data including the observation schedule (scenario 22b, scenario 23b), standard projection reference systems (scenario 13, Bruce Barkstrom, #632), and session histories and statistics to users (scenario 9, Jan Poston, #638).

Part of the reason that these recommendations remain statused as design consideration is due to the fact that they are specific in their implementation. These recommendations have been taken as suggestions to the ECS engineers for consideration during their planning of the requested capabilities and features. Initial analysis suggests that the Flight Operations Segment (FOS) should provide the observation schedule automatically as a service to the on-line users.

Although a number of standard projections will be provided by ECS, final decisions regarding the specific projections contained on that list have not yet been made. Currently, ECS developers are considering various map projections which are described in *Map Projections - A Working Manual* (John P. Snyder, U.S. Geological Survey Professional Paper 1395, United States Government Printing Office, Washington: 1987). In order to finalize the list, developers will solicit input from the scientific community as well as the ECS DAACs.

In providing session history and statistics, the scientist wants a log (or recorded history) of the requests that she makes along with response time, volume of metadata returned, etc. and then copied to her local directory or output device. ECS is planning to provide some sort of log-on history and statistics such as search time and number of hits. ECS may additionally provide all of the information in this example which would be design considerations.

3.3.7 User Interface

3.3.7.1 User profile for each session

Another user recommends that the ECS architecture provide for a user profile to exist with each session (scenario 15, Raul Lopez, #611). This user would like to create a user profile type of file that would be accessed each time data is ordered. This file would contain the geophysical parameters of interest to him and the method by which his data order should be filled (on media, ftp, etc.). This functionality requires that the user profile datafile be editable by the user. Using this file, he would be able to tailor some functions of ECS to exactly meet his needs. Possibly, multiple ones would be resident in the user account. ECS provides for this capability as stated in requirement IMS-0050, which provides for the ability to define and modify user profile information. In addition, this user requires that a temporary, non-standard plot be automatically generated from one of the standard Level 1B data products when he begins his session each day.

3.3.7.2 Voice-driven menus

Because of the evolutionary nature of the ECS project, consideration of seemingly "super-advanced" search methods also must be considered. The current technology is not mature enough for the ECS to provide voice-driven menus (#603); however, because this system will not be completely operational until 1998, these types of suggestions will be analyzed. This depends on low cost client or operating system level software supporting voice-driven menus. This may fall under evolutionary development and depends heavily on future hardware and software availability. This design issue may need both a cost and impact assessment at a later date. It currently awaits more definition in the COTS arena.

3.3.8 Comments/Suggestions

Some of the "recommended requirements" culled from the scenario development process fall into this non-functionally-based category called comments / suggestions. These are generally not written in requirements language; instead, users have identified ideas that should be considered or recognized at the development level of design.

3.3.8.1 Examination of existing new technology within industry and consideration of object-oriented architecture

Examination of existing new technology within industry (#520) is a concern of Mark Abbott. ECS needs continual infusion of new technology and should be examining some models in industry. Currently, the ECS project maintains a Technological Assessment Team for these types of concerns. Another suggestion presented by the same scientist encourages object oriented architecture to be considered (#521). ECS is already aggressively considering the object-oriented architecture with plans for everything to be object-oriented by EP4. The SDS contains extensive discussion on the implications of object-oriented software, both within ECS and in software that interfaces to it.

3.3.8.2 Sharing information and ECS data among teachers

An issue from the Educational segment of the science community suggests that teachers will want the capability to share information and data with other teachers (Donald Foss, scenario 7old). In this scenario, the high school teacher wants to be able to share data and information with other teachers in his state. Modeling efforts estimated that 2-6 "educational servers" may be established by either commercial or government organizations which would provide value-added products to meet non-science community needs. These servers should provide the ability to share data, since these servers will cater to the educational needs of the community. Therefore, the use of specialized servers will reduce the demand on resources and the amount of direct interaction between this community and EOSDIS.

3.3.8.3 Increases in data demands coincident with significant natural events

It is likely that demand for data will sharply increase after events such as volcanic eruptions, floods, etc., and demand will drop off rapidly as well. ECS should devise a plan for handling this type of situation. It has been suggested that there will be a sharp increase in data demands coincident with significant natural events (#527). This record deals with the "peaks and valleys" of data distribution. The IMS requirements specify an "average" load with *x* users and *t* response time, with the peaks listed within the specifications and the numbers sized to handle the peaks. The user and performance modeling effort will be determining if the response times estimated are achievable. Upon completion of this analysis, the requirements may be updated, but currently this concern matches several requirements: EOSD-3820, IMS-1780, and IMS-1785.

3.3.8.4 Telephone and mail ordering through the year 2000

Most users have asked for data electronically (assuming cost will be acceptable) with only a very small percentage requesting data on physical media. However, a suggestion gathered in scenario collection from a commercial user indicates that, for security reasons, data ordering from some members of this community will be primarily through telephone and mail through the year 2000 (#530). Because of this, it is suggested that accommodations be made within the ECS architecture to ensure confidentiality of request and delivery for all users that may make such requests.

3.4 Status of recommendations from user scenarios

In general, there are seven different statuses to which a user's recommendation can be assigned. The user recommendations resulting from the scenario collection process that are described in this document currently have one of four statuses assigned to them: requirement, implementation detail, evolutionary, and design issue. The definition of each of these statuses is described below. The last subsection contains a table depicting the status of each recommendation as of 25 July, 1994.

3.4.1 Requirement

The Requirement category represents recommendations that already match existing requirements in the current specifications document. Requirement numbers must be located before these recommendations can be marked as "accepted". In many cases the recommendation describes an "implementation detail" and must be reviewed by the Screening Team before the entry can be re-statused. See section 2.2 for more information on the RRDB review process.

3.4.2 Implementation Detail

Many recommendations fall very close to matching an existing requirement, however they may present details within the recommendation that are more specific than the requirement itself. In these cases the recommendation may represent a "fleshing out" of the requirements. Because of this fleshing out process, many requirements have been updated and revised to reflect more completely the requirements desired by the ECS users. Relatively few completely "new" requirements surfaced as a result of this functional analysis, which speaks well of the research and on-going efforts to try to meet the needs of the scientific community.

3.4.3 Evolutionary

Items or suggestions that are categorized as evolutionary are not currently feasible based on the scope of the project (as indicated in the F&PRS document) or in some cases based on the lack of technological feasibility. This category will be taking on increasing significance since ECS is required to evolve as user needs and technologies change. This ECS evolvability requirement is defined as the ability of the architecture to accommodate changes to the requirements, design or implementation in a timely and cost effective manner with minimal disruption to ongoing system-wide operations.

To capture these desired user-driven changes in a timely manner, a meaningful dialogue must be maintained with various elements of the user communities. Continued dialogue with users results in an awareness of the changes taking place; for instance, scientists may change the manner in which they conduct their research due to the incorporation of new system capabilities (e.g., EOSDIS Version 0, high performance commercial communications, more affordable and greater computing power). An example of the user-driven changes which may take place is that search strategies and data access methods are expected to evolve over time in response to the changing information needs and utilization patterns of the research community.

3.4.4 Design Issue

Recommendations categorized as design issues represent functions that need re-examination at future points in system design, because the details cannot yet be resolved. In addition, cost and impact analyses often need to be completed, which require additional time. Design issues differ from implementation details because they generally require the collection of additional information about the system design or that further analyses be completed. Based on the ECS Release Plan several of these design issues have been marked for re-evaluation at a more appropriate point in the design process.

3.4.5 Current status of recommendations

Table 3.3 summarizes the user recommendations resulting from the scenario collection process. Each entry in the table provides the current status category of each recommendation, the high-level functional group to which the recommendation is assigned, a short description of the recommendation itself, and the RRDB entry number by which the progress of the recommendation may be tracked.

Table 3.3 Summary of user recommendations produced by the scenario collection process (status categories are described in sections 3.4.1 through 3.4.4 of this document)

Status Category	High-Level Function	Lower-Level Functions - Summary of Function	RRDB#
Requirement	Ancillary Access	ECS should provide access to orbital prediction model to user and user processes	630
	Comment/Suggestion	Examination of existing new technology within industry	520
	Comment/Suggestion	Object oriented architecture should be considered	521
	Comment/Suggestion	Sharp increase in data demands coincident with significant natural events	527
	Processing	Users will ask the system to do processing and reprocessing which is beyond standard products	522
	Search/Subset/Order	ECS Architecture should retain search criteria	610
	Search/Subset/Order	ECS Architecture should support data subsetting by parameter, combination of parameters, or any layer of the data pyramid (L0, L1, etc.)	618
	Search/Subset/Order	ECS Architecture to allow user to specify number of product(s) output from generated by search	626
	Search/Subset/Order	ECS should support requested data takes and orders when event monitor occurs	602(b)
	Search/Subset/Order	ECS should provide capability to provide standing order on documents as well as data	613

Status Category	High-Level Function	Lower-Level Functions - Summary of Function	RRDB#
	Search/Subset/Order	Architecture should provide user a verification of products ordered and query to refuse product ordered before completing order	627
	Storage/Archive	There is a need for historical accounting of data	524
	User Interface	ECS Architecture should provide for a user profile to exist with each session	611
	User Interface	ECS Architecture should verify user hardware/software capabilities before sending a full browse image to user's machine	628
	Visualization Utilities	ECS to provide movie-loop capability	607
Implementation Detail	Ancillary Access	ECS Should provide the capability to graphically display and provide GIS file of Instrument Ground Track Swaths for requested time frame	629
	APIs/Interoperability	ECS Architecture to route standing order data to temporary SCF (field terminal)	606
	APIs/Interoperability	ECS Architecture should support API developed by users	622
	APIs/Interoperability	ECS Architecture must provide ability to use User defined statistical packages	634
	APIs/Interoperability	ECS to provide capability to upload user developed data processing algorithms	639
	APIs/Interoperability	ECS to provide alarm history when monitoring event occurs	645
	Search/Subset/Order	ECS to allow user field terminal to act as a temporary SCF (field terminal)	605
	Search/Subset/Order	ECS to allow a user's field terminal a priority for receiving data	616
	Search/Subset/Order	ECS to provide capability to display paired search and QA results	631
	Storage/Archive	Send data order to temporary storage until requested by field researcher	615
	Visualization Utilities	ECS should provide capability to graphically display QA data for a given area	604
Evolutionary	Ancillary Access	ECS Architecture should support access of GIS related Products through EOSDIS	625
	APIs/Interoperability	Use of DBMS for sub-image tracking	633
	Comment/Suggestion	Teacher wants to share information and data with other teachers	526
	Comment/Suggestion	Data ordering will be primarily through telephone and mail through year 2000	530
	Processing	ECS should allow users to construct code using results from regression trees for application to whole images	620

Status Category	High-Level Function	Lower-Level Functions - Summary of Function	RRDB#
	Processing	ECS Should allow users to run IDL code on sub-images	621
	Visualization Utilities	ECS Architecture to provide for multiple non-over lapping windows capable of displaying synchronized movie-loops	608
	Visualization Utilities	ECS to provide unique zoom capability	642
Design Issue	Ancillary Access	ECS Should provide standard projection reference systems	632
	Ancillary Access	ECS should provide users access to observation schedule	635
	Ancillary Access	ECS to provide session history and statistics to user	638
	APIs/Interoperability	Users need interoperability with standard statistical packages and database management systems	528
	APIs/Interoperability	ECS Architecture should provide access links for user work stations to obtain large volumes of data with low-level tools	636
	APIs/Interoperability	ECS to monitor MODIS data with API	644
	APIs/Interoperability	ECS should support requested data takes and orders when event monitor occurs	602 (a,c)
	Processing	Users want data access, processing etc. without data delivery	523
	Processing	ECS Ingest capabilities	529
	Search/Subset/Order	ECS to provide capability to order data for post and future data with one request	609
	Storage/Archive	ECS to allow storing processed data for use by other users	637
	User Interface	ECS Architecture should provide for future capability of voice driven menus	603
	Visualization Utilities	ECS should encourage collaboration	525
	Visualization Utilities	ECS Architecture should support telecasting, and interactive video	601
	Visualization Utilities	ECS Architecture to route standing order data to temporary SCF (field terminal)	612

4. ECS Policy Implications from Scenario Functional Analysis

4.1 High-level Analysis of Functions with Policy Issues

This section provides a high-level analysis of functions that involve policy issues which have not yet been resolved. It is meant to reiterate those policy implications that were mentioned, usually in the context of other issues, in the previous section of this paper. When it is determined by the RRDB Administration and the Screening Team that a recommended requirement involves a policy issue, several steps are taken to ensure that the recommendation is processed through the appropriate channels. For example, cost-related or pricing policy issues are forwarded to the appropriate ECS contacts and sent for cost impact studies. The issue and impact studies are then sent to NASA-ESDIS for resolution.

4.1.1 Allocation of ECS Resources

Certain privileges have been set aside for the NASA-funded EOS investigators, such as the 10% processing resource, which have not been formally allocated. User requests for processing and reprocessing capabilities beyond ECS standard products defines one of the policy issues that elicit compromises between scientists and developers.

Several user requests have expressed a desire for ECS to ingest a variety of data sets. However, policies regarding the criteria or guidelines for ingest of data sets have not been determined to date. Once these policies are established by NASA, they would review and approve all data sets submitted to ECS for storage, maintenance, processing and distribution to ensure compliance with the policies including those associated with data quality standards. In the interim, however, it is desirable to develop a time-phased estimate of the nature and size of these data sets to support the various design activities.

4.1.2 Support of collaboration through visualization technologies

Visualization technologies, such as movie-loops, interactive video and telecasting, which currently require wide-band video, significantly increase the amount of data transmitted through ECS. Because motion picture compression techniques are currently under development, installation of motion picture functionality before these standards mature will cause unnecessary government investment in processing and inter-site circuit resources. Once these technologies mature, this policy issue can be re-evaluated with the new pricing measures. Decisions can then be made on which collaboration techniques should be made available to the ECS users.

Appendix A: User Scenario Matrices

The User Matrix is a tool used for classifying science users to capture the full range of the way users are expected to interact with EOSDIS. The left column represents style of access currently expected by the science users, while the top row identifies scale of endeavor.

The current User Scenario Matrix used in the development of this White Paper is dated June 17, 1994. It contains twenty-seven *science* user scenarios and is shown on page A-2 of this document.

The December 1993 User Matrix classified non-science users as well as science users. The focus of the user matrix was modified in January of 1994, however, this former user matrix is included in this document for completeness (see page A-3). Again, the left column represents style of access currently expected by the users, while the top row identifies scale of endeavor. Scenarios referred to in this document as "scenario xxxold" can be found on this matrix.

June, 1994 Science User Matrix

June 17, 1994

	Reviews	Local/Field/Case Studies	Regional Studies	Global Studies
Traditional User contacting EOSDIS directly	Ph D student needs information for dissertation lierature review *David Flittner* *Kathryn Neel* 1	Researcher studying lightning associated with flash floods *Ronald Holle* *Lori Tyahla* 2	Test ecological theory regarding vegetation competition in grasslands across the central U.S. *Don Strebel (Piers Sellers)* *Celeste Jarvis* 3	International researcher (Scotland) developing Forest Model *Andrew Friend* *Kathryn Neel* 4
Data Consumer	Earth Science Researcher wishes to access electronic journal *Jeff Dozier* *Lori Tyahla* 5	Regional Park Land Management (VA) *Jerry Garegnani* *Joe Miller* 6	Development of method to integrate data sets of varying resolutions. *Dan Baldwin* *Lori Tyahla* 7	Study of Biomass burning *Chris Justice* *Tess Wingo* 8
Data Browser	Undergrad. in Remote sensing class needs info on EOS instruments and Data sets *Jan Poston* *Tess Wingo* 9	Land Surface Hydrologic Model *Ted Engman* *Joe Miller* 10A	Arctic Icepack Response to Weather *John Heinrichs* *Celeste Jarvis* 11 A	Mid-latitude and tropical interactions - precipitation forcing *Jim Stobie (Ricky Rood)* *Celeste Jarvis* 12
		Validation of CLoud Properties With Field Data *Bruce Wielicki* *Haldun Direskineli* (Wingo) 10B	Derivation of Snow Water Equivalents *John Walsh* *Khalsa/Kaminski* (Wingo) 11B	
			Radiative Fluxes over sea ice *Jeff Key* *Khalsa/Kaminski* (Wingo) 11C	
Analytical User	Earth Science Community User; e.g., University Prof., Radiation Budget *Barkstrom (CERES)* *Haldun Direskinelli* (Wingo) 13	Development of Automated Snow Mapping Procedure (Sequoia 2000 Scenario) *Walter Rosenthal* *Lori Tyahla* 14	NOAA researcher studying seasonal and diurnal variation in regional lightning distribution *Raul Lopez* *Lori Tyahla* 15	Southern Ocean Large-Scale Circulation *Leonard Walstad* *Tess Wingo* 16
Production User		Watershed modeler Updating model inputs and providing output to EOSDIS *Jim Hannawald (EPA)* *Joe Miller* 18	Biogeochemical fluxes at the Ocean/Atmosphere Interface *Catherine Goyet (Peter Brewer)* *Kathryn Neel* 19	ISI Global Water Cycle; includes model verification through field studies. *Eric Barron* *Jarvis/Miller* 20
Machine-to-Machine Interface User		Thermal Alarm System for Detection of Volcanic Eruptions *Luke Flynn* *Lori Tyahla* 22A	Stratospheric chemisry and dynamics *Leslie Lait (Mark Schoeberl)* *Mike Theobald* 23A	EOS Instrument Investigator; e.g., MODIS, Ocean Color *Mark Abbott* *Celeste Jarvis* 24
		Climatic and tectonic processes in the Andes mountains *Bryan Isacks* *Tyahla / Miller* 22B	Validation of Passive Microwave Algorithm for Precip. retrieval *Michael Goodman* *Danny Hardin* (Tyahla) 23B	

December, 1993 User Matrix

December 10, 1993

	General Info Searches	Reviews	Theoretical Studies	Case Studies	Field Studies	Climatologies/Global
Intermediary to Education or Policy Community (e.g., CIESIN, S4 proposals	Intermediary to Dept. of Education; high-level summary of meteorological data for grades K-12 *Bill Emery* 1	Lawyer hires intermediary; summary of snowfalls for lawsuit against a ski company *Edward Calvin* *Tyahla/Theobald* 2	Sociologist; hypothesis- people of means live upwind of industry in urban areas. *Dave Walker* *Tyahla/Theobald* 3	Writer for McGraw-Hill needs to prepare a text demonstrating EOSDIS via progressively complicated examples 4	Intermediary under contract to Dept. of Ed. prepares science lesson plans for Internet-wide distrib. 5	Sociologist - "people/park conflict"- 25 large game reserves in sub-Saharan Africa. *Michael Garstang* *Tyahla/Theobald* 6
Traditional User contacting EOSDIS directly	High School Teacher; wants students to get radiance data to correlate with properties of river water samples *Donald Foss* *Lori Tyahla* 7	Virginia Coast Reserve Long-Term Ecological Res. Prog. - mapping and tracking vegetation dynamics *Raymond Deuser* *Tyahla/Theobald* 8	Test ecological theory regarding vegetation competition in grasslands across the central U.S. *Don Strebel* *Celeste Jarvis* 9	Insurance Co. Rep.; wants geographical extent of Mississippi River Flood to verify claims *Bill Kennedy* *John Daucsavage* 10	Cryosphere; researcher using surface reflectance to determine age of ice surface on land *Chris Shuman* *Celeste Jarvis* 11	Intn'l Monetary Fund; wants data to verify credit worthiness of multi-billion dollar loan for irrigation project 12
Character text user	News reporter; wants before and after photos of Mississippi River flood area *Bill Kennedy* *John Daucsavage* 13	Undergrad. Student in intro. to Remote Sensing needs to research what instruments/data sets are compatible with senior thesis *Jan Poston* *Lori Tyahla* 14	NOAA researcher studying seasonal and diurnal variation in regional lightning distribution *Raul Lopez* *Lori Tyahla* 15	Forest Ranger preparing a report for a Department of Interior Policy Maker needs pre- and post- forest fire data to assess recovery *Donald Ohlen* *John Daucsavage* 16	An oil company needs regional geological and vegetative data to determine best drilling sites. *Bill Kennedy* *John Daucsavage* 17	Political Science Professor at a small college wants to correlate NDVI data with global population and GNP data *Jeff Eidenshink* *John Daucsavage* 18
Data Consumer (Moderate Access)	A local government near LA wants daily ocean color data delivered once/month (algal growth) *Carolyn Whitaker* 19	Earth Science Researcher wishes to access electronic journal *Jeff Dozier* *Lori Tyahla* 20	NSIDC Scenario #3 Snow depth and Extent; Polar Jet Stream *John Walsh* *Khalsa/Kaminski* 21	MSFC Scenario #2 Global wind field detection; aerosol backscatter-case study oriented *Dave Emmitt* *Theobald/Tyahla* 22	ISI Global Water Cycle;, includes model verification through field studies; *Eric Barron* *Lori Tyahla* 23	NSIDC Scenario #1 Surface and top-of-atmosphere radiative fluxes over sea ice during summer (2 yrs.) *Jeff Key* *Khalsa/ Kaminski* 24
Data Browser (Frequent Access)	Research Librarian *Cristina Sharretts* *Tyahla/Theobald* 25	Investigation of algorithms involving a wide range of EOS instruments which will provide detection, tracking, and warning of volcanic events and ejectamenta. 26	Earth Science Community User; e.g., University Prof., Radiation Budget *Barkstrom (CERES)* *Haldun Direskinelli* 27	Instrument Support Terminal User; e.g., ASTER Team Member *Bob Hekl* *Tyahla/Theobald* 28	Use of Cryospheric System to Monitor Global Change in Canada; *Rejean Simard* *Lori Tyahla* 29A --- Arctic Ice pack response to weather *John Heinrichs* *Celeste Jarvis* 29B	Changes in Biogeochemical Cycles; *Berrien Moore, III* *Mike Theobald* 30
Analytical User (Frequent Access)	31	*H. Grant Goodell* *Tanya Furman* *Tyahla/Theobald* 38	Stratospheric chemisry and dynamics *Leslie Lait* *Mike Theobald* 33	Detection and classification of transparent cirrus clouds. *Dan Baldwin* *Tyahla/Theobald* 34	Interdisciplinary Ocean/Atmosphere Field Campaign (a la TOGA-COARE *Jim Wang & David Short* *A. K. Sharma* 35	Climate, Erosion, and Tectonics in Andes and other mountain systems; *Bryan Isacks* *Theobald/Tyahla* 36
Production User (Frequent Access)	37		MSFC Scenario #1 Validation of passive microwave algorithm for precipitation retrieval *Michael Goodman* *Danny Hardin* 39	Commercial User; value-added products *John Daucsavage* 40	Interdisciplinary Investigation of Clouds and Earth's Radiant Energy System; *Bruce Wielicki* *Mike Theobald* 41	GCM Modeler ; *Jim Stobie* *Celeste Jarvis* 42A --- EOS Instrument Investigator; e.g., MODIS, Ocean Color *Mark Abbott* *Celeste Jarvis* 42B
Advanced Technology User	43	44	Intn'l Interdisciplinary PI; e.g., will event recognition software work on L4 data to flag a particular event? *Mouginis-Mark* *Lori Tyahla* 45	Development of Automated Snow Mapping Procedure (Sequoia 2000 Scenario) *Walter Rosenthal* *Lori Tyahla* 46	Calibration/Validation of MODIS Ocean Products *Bob Evans* *T heobald & Tyahla* 47	AIRS Team 48

Abbreviations and Acronyms

API	Application Program Interface
ASTER	Advanced Spaceborne Thermal Emission and reflection Radiometer
CCB	Change Control Board
CDR	Critical Design Review
CERES	Clouds and Earth's Radiant Energy System
COTS	Commercial Off-the-Shelf
CPU	Central Processing Unit
DAAC	Distributed Active Archive Center
DADS	Data Archive and Distribution Segment
DAR	Data Acquisition Request
DBMS	Data Base Management System
DPFT	Data Processing Focus Team
ECS	EOSDIS Core System
EDOS	EOS Data and Operations System
EP4	Evaluation Package 4
ESDIS	Earth Science Data and Information System (NASA)
F&PRS	Functional and Performance Requirements Specifications
FOS	Flight Operations Segment
GIS	Geographical Information System
GSFC	Goddard Space Flight Center
GUI	Graphical User Interface
IDL	Image Display Language
IMS	Information Management Segment
MB	megabyte
MISR	Multi-angle Imaging Spectrometer
MODIS	Moderate Resolution Imaging Spectrometer
MSFC	Marshall Space Flight Center
MTPE	Mission to Planet Earth

NASA HQ	National Aeronautics and Space Administration Headquarters
NLDN	National Lightning Detection Network
PDR	Preliminary Design Review
PGS	Product Generation Segment
QA	Quality Assurance
RRDB	Recommended Requirements Database
RST	Research Search Tool
SCF	Science Computing Facility
SDR	System Design Review
SDPS	Science Data Processing Segment
SDTS	Spatial Data Transfer Standard
SDS	System Design Specification
SPSO	Science Processing Support Office
TMDB	Technical Management Database